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SCIENCE TEACHER COMPETENCIES
IN THE MIDDLE SCHOOL

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Abstract

The nature of generic teacher competencies is described with specific reference to competencies endorsed by the Georgia State Department of Education. Several sources of generic competencies for middle school teachers are also identified and discussed. In addition, five generic competencies for science teachers are presented. A synthesis of middle school and science teacher generic competencies is presented in three categories, viz., planning, implementing, and evaluating. The synthesis provides researchers and supervisory personnel with a partial listing of middle school science teacher competencies.

Science Teacher Competencies in the Middle School

Desirable teaching skills, hereafter referred to as competencies, have been ascertained through task analysis procedures and through reviews of the literature on effective teaching and learning (1, 5, 8). A major effort of researchers who sought to identify teacher competencies during the 1970's was to discover competencies applicable to teachers regardless of what they teach. Major efforts toward that end are reflected in the generic competencies and related indicators endorsed by the Georgia Department of Education.

Science teachers in all grades should be aware of competencies essential to teaching. The Teacher Performance Assessment Instruments: A Handbook for Interpretation (3) provides insight into the process used to derive competencies. The same document describes instruments "...designed to determine how well teachers can demonstrate selected competencies..." (p. 1) as part of certification requirements. Each competency and its accompanying indicators are listed below:

1. Plans instruction to achieve selected objectives.
 - 1.01 Specifies or selects learner objectives for lessons.
 - 1.02 Specifies or selects teaching procedures for lessons.
 - 1.03 Specifies or selects content, materials, and media for lessons.
 - 1.04 Specifies or selects materials and procedures for assessing learner progress on the objectives.

- 1.05 Plans instruction at a variety of levels.
2. Organizes instruction to take into account individual differences among learners.
 - 2.01 Organizes instruction to take into account differences among learners in their capabilities.
 - 2.02 Organizes instruction to take into account differences among learners in their learning styles.
 - 2.03 Organizes instruction to take into account differences among learners in their rates of learning.
3. Obtains and uses information about the needs and progress of individual learners.
 - 3.01 Uses teacher-made or teacher-selected evaluation materials or procedures to obtain information about learner progress.
 - 3.02 Communicates with individual learners about their needs and progress.
4. Refers learners with special problems to specialists.
 - 4.01 Obtains and uses information about learners from cumulative records.
 - 4.02 Identifies learners who require the assistance of specialists.
 - 4.03 Obtains and uses information from co-workers and parents to assist with specific learner problems.
5. Obtains and uses information about the effectiveness of instruction to revise it when necessary.

- 5.01 Obtains information on the effectiveness of instruction.
- 5.02 Revises instruction as needed using evaluation results and observation data.
- 6. Uses instructional techniques, methods, and media related to the objectives.
 - 6.01 Uses teaching methods appropriate for objectives, learners and environment.
 - 6.02 Uses instructional equipment and other instructional aids.
 - 6.03 Uses instructional materials that provide learners with appropriate practice on objectives.
- 7. Communicates with learners.
 - 7.01 Gives directions and explanations related to lesson content.
 - 7.02 Clarifies directions and explanations when learners misunderstand lesson content.
 - 7.03 Uses responses and questions from learners in teaching.
 - 7.04 Provides feedback to learners throughout the lesson.
 - 7.05 Uses acceptable written and oral expression with learners.
- 8. Demonstrates a repertoire of teaching methods.
 - 8.01 Implements learning activities in a logical sequence.
 - 8.02 Demonstrates ability to conduct lessons using a

variety of teaching methods.

8.03 Demonstrates ability to work with individuals, small groups, and large groups.

9. Reinforces and encourages learner involvement in instruction.

9.01 Uses procedures which get learners initially involved in lessons.

9.02 Provides learners with opportunities for participating.

9.03 Maintains learners involvement in lessons.

9.04 Reinforces and encourages the efforts of learners to maintain involvement.

10. Demonstrates an understanding of the school subject being taught and demonstrates its relevance.

10.01 Helps learners recognize the purpose and importance of topics or activities.

10.02 Demonstrates knowledge in the subject area.

11. Organizes time, space, materials, and equipment for inspection.

11.01 Attends to routine tasks.

11.02 Uses instructional time effectively.

11.03 Provides a learning environment that is attractive and orderly.

12. Demonstrates enthusiasm for teaching and learning and the subject being taught.

12.01 Communicates personal enthusiasm.

- 12.02 Stimulates learner interest.
- 12.03 Conveys the impression of knowing what to do and how to do it.
- 13. Helps learners develop positive self concepts.
 - 13.01 Demonstrates warmth and friendliness.
 - 13.02 Demonstrates sensitivity to the needs and feelings of learners.
 - 13.03 Demonstrates patience, empathy and understanding.
- 14. Manages classroom interactions.
 - 14.01 Provides feedback to learners about their behavior.
 - 14.02 Promotes comfortable interpersonal relationships.
 - 14.03 Maintains appropriate classroom behavior.
 - 14.04 Manages disruptive behavior among learners.
- *15. Meets professional responsibilities.
 - 15.01 Works cooperatively with colleagues, administrators, and community members.
 - 15.02 Follows the policies and procedures of the school district.
 - 15.03 Demonstrates ethical behavior.
 - 15.04 Performs extra-instructional duties.
- *16. Engages in Professional self-development.
 - 16.01 Participates in professional growth activities.
 - 16.02 Shares and seeks professional materials and ideas.

*NOTE: These competencies are not required for certification purposes. They may be used as an option for staff development purposes.

The value of generic competencies to the science teacher lies partly in the implications for minimally expected performance. That is, the competencies and their related indicators provide guidelines for basic teacher performance when teaching general science, life science, earth science, or physical science in the middle school. Thus, science teachers have minimum performance standards believed to be essential to effective professional conduct.

Competencies for Teachers in Middle Schools

In addition to formulating generic competencies, researchers have attempted to identify competencies essential to middle school settings. As might be expected, however, many competencies for middle school teachers are appropriate for teachers in a variety of grades. That is, most listings of competencies for middle school teachers contain items that are generic in nature and, therefore, applicable to all teachers. The following studies may be of interest to curriculum coordinators and teachers who have an interest in developing and validating competencies for middle school science teachers: Gatewood (4) surveyed five middle school teacher preparation programs and identified competencies for in-service and prospective middle school teachers. Klingele (6 , p.42) suggested that there are two crucial competencies for middle school teachers. Marshall and Holms (7) identified over fifty competencies. Walter and Fanslow (10) attempted to validate competencies for home economic and other middle school teachers.

The nature of competency statements for middle school teachers should be of interest to professional educators. A publication of

the Association for Supervision and Curriculum Development (9, p. 19-21) provides an example of twenty competency statements believed to be essential for effective teaching in the middle school:

1. Shows awareness of his or her own behavior patterns and how they are influenced by situations and by his or her beliefs; awareness of personality characteristics; acceptance of a variety of behavior in others that differs from his or her own.
2. Interacts constructively with other adults and with transescents; shows regard for persons; is approachable, responsive, and supportive.
3. Understands the physical development process of the transescent student and organizes his or her teaching according to that process.
4. Understands the intellectual developmental process of the transescent student and organizes his or her teaching according to that process.
5. Understands the socio-emotional developmental process of the transescent student and organizes his or her teaching according to that process.
6. Understands the career developmental process

- of the transescent student and organizes his or her teaching according to that process.
7. Understands and applies various theories of the teaching-learning process; analyzes the learning patterns of individual students, prescribes for those and evaluates results.
 8. Incorporates a knowledge of group dynamics in his or her teaching and helps students understand group process, group decision making, leadership skills, and peer influence.
 9. Promotes positive relationships between the school and the community, between the teacher and parents, and between various subcultures in the school.
 10. Organizes curriculum plans and opportunities appropriate to the middle school (those that facilitate the developmental tasks of transescence and are responsive to community problems).
 11. Uses appropriate procedures of managing an instructional program—designing, conducting, evaluating, and revising curriculum and instruction.
 12. Makes effective presentations using appropriate media.

13. Deals effectively with unusual classroom problems.
14. Counsels individual students, promoting self-direction through indirect guidance.
15. Helps students to consider alternative values and to develop personal workable valuing systems.
16. Teaches students techniques of problem solving.
17. Provides opportunities and guidance to help students become independent learners (define own goals and problems, identify resources, and evaluate outcomes).
18. Designs and conducts group activities according to the kinds of learnings that are facilitated by the different groupings.
19. Has skills of working in cooperative teaching situations—with other teachers, paraprofessionals, and resource persons.
20. Accepts responsibility of multidisciplinary instruction; plans thematic and coordinated studies with other teachers; and assists them in teaching subjects outside of his or her own area of specialization.

Competencies for Science Teachers

The "scientifically minded person" is characterized by Blough and Schwartz (2 , p.78) in the following terms:

- open minded---respects views of others
- patient---deliberates; does not jump to conclusions
- thorough---consults reliable sources; accurate
- realistic--not superstitious; nothing happens without cause
- curious---attempts to determine cause-effect relationships
- plans---investigations are planned before experimenting

Being scientifically minded is definitely necessary, but it is not a sufficient criterion for effective science teaching. One can, however, derive from science teacher competencies from the characteristics of the scientifically minded person:

An initial listing of science teacher competencies may include some or all of the following items:

1. Demonstrates knowledge of science facts, concepts, and principles
2. Plans and implements learning activities, including laboratory experiences, appropriate to learner's cognitive development (i.e., specifically, the concrete and formal operational stages of development)

3. Involves students in activities that emphasize science process skills (i.e., observing, classifying, communicating, measuring, inferring, predicting, number relationships, time/space relationships, formulating hypotheses, controlling variables, interpreting data, defining operationally, and experimenting)
4. Implements teaching methodologies that focus on inquiry
5. Evaluates cognitive and affective outcomes of the science curriculum

At this point it may be helpful to examine the relationships among generic competencies, competencies for science teachers, and competencies for middle school teachers. Figure 1 provides a graphic representation of interrelationships among competencies thus far discussed. It can be seen in Figure 1 that generic competencies subsume science and middle school teacher competencies. It can also be seen that there is an intersection of science and middle school teacher competencies. This intersection is highly significant because it is out of this intersection that competencies can be synthesized which are appropriate for middle school science teachers.

Competencies for Middle School Science Teachers

It seems reasonable to expect that middle school science teacher competencies should be logical extensions of generic competencies. They should also take into account the competencies for middle school

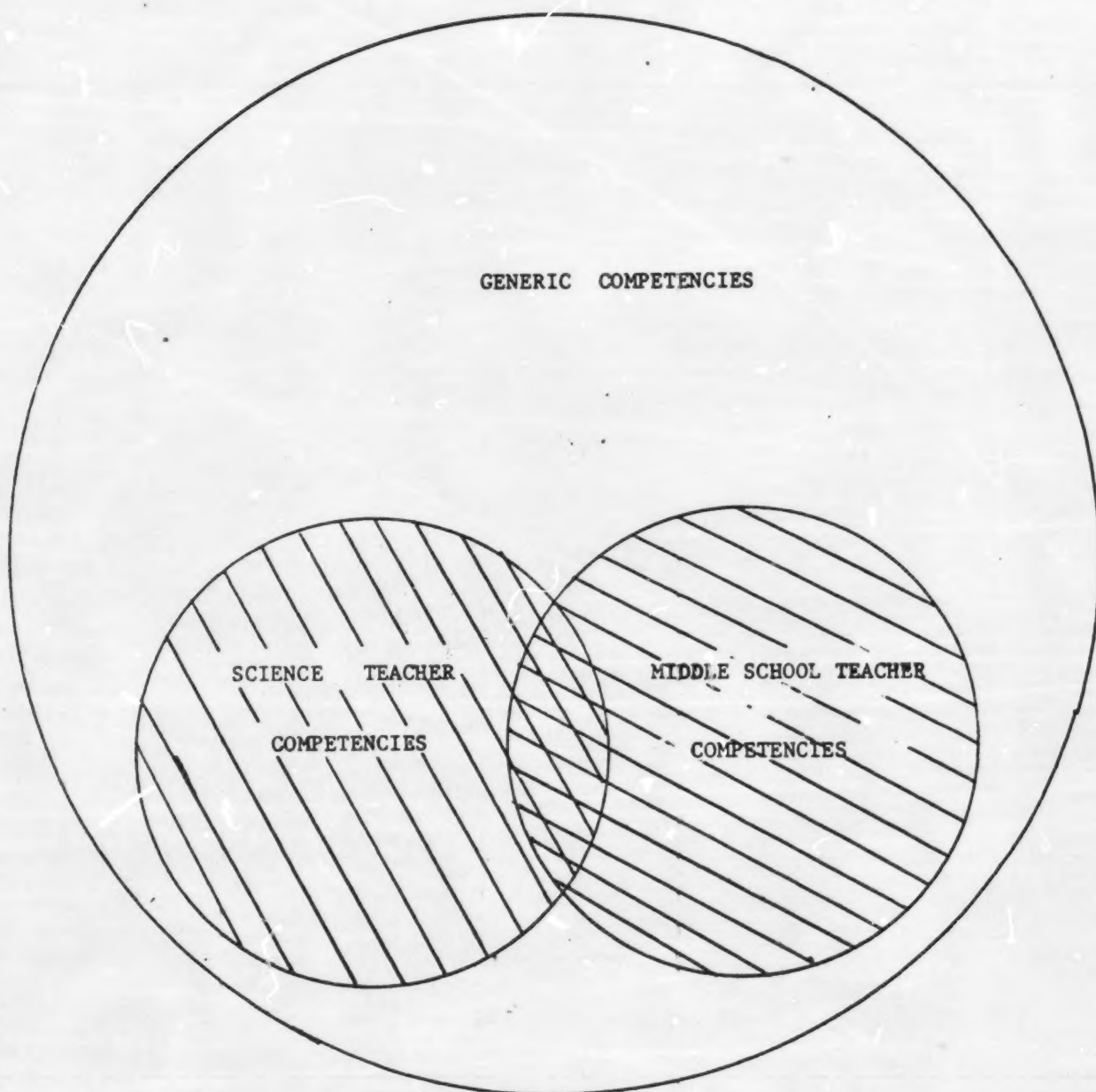


Figure 1. Interrelationships Among Competencies

teachers and the competencies for science teachers. The following listing of competency statements is offered as a partial synthesis of the three categories of competencies previously described:

Planning

1. Develops science lesson plans in cooperation with team members
2. Identifies science community resources relevant to an interdisciplinary unit of study
3. Specifies relationships among science content and process skills as they relate to a unit theme
4. Writes science activities that are related to the unit theme
5. Assumes leadership role by directing the planning process for a unit of study with an emphasis on science
6. Develops plans for implementing blocks of time for small and large groups of students for independent study of science
7. Plans enrichment activities for students who quickly master science processes and/or facts, concepts, and principles
8. Plans activities to remediate students who have persistent difficulty in mastering science process skills and/or facts, concepts, and principles
9. Plans for field trip and develops appropriate

science activities

10. Develops one or more value education activities appropriate for a team developed unit of study
11. Develops science learning centers appropriate for subject matter and diagnosed needs of students
12. Suggests ideas and assists in planning for large group meetings of all students assigned to a teacher team for the purpose of viewing films, hearing guest speaker, participating/viewing a skit or play, etc., related to science.
13. Suggests ideas for and assists in planning a culminating activity that emphasizes inter-relationships among science objectives and objectives in other subject matter areas

Implementing

1. Provides students with materials appropriate for inquiry science activities
2. Organizes students into groups to carry out tasks related to the unit of study
3. Uses a variety of inquiry approaches consistent with the cognitive development of learners
4. Carries out strategies focusing on the experi-

mental approach of teaching inquiry skills

5. Uses questions appropriate for a particular inquiry approach while teaching a science lesson
6. Supervises students working in science learning centers and students working on independent projects during class time
7. Supervises students working with learning activity packages or other teacher developed independent activities
8. Conducts values education activities
9. Supervises students on field trips and implements appropriate follow-up activities

Evaluating

1. Diagnoses student needs through pretests, observations, interviews, etc.
2. Prescribes science activities based on diagnosis
3. Assesses students' ability to recall, comprehend, and apply facts, concepts, scientific principles, and science-related issues
4. Assesses students' ability to analyze, synthesize, and evaluate facts, concepts, scientific principles, and science-related issues
5. Assesses students' attitudes with regards to con-

cepts, process skills, and science-related issues

6. Provides feedback to students on their progress in science

Development and validation of competencies for middle school science teachers is in its infancy and should be an on-going endeavor. The preceding list provides a basis upon which curriculum coordinators and middle school science teachers can develop and validate competencies appropriate to their own middle school.

Local efforts to develop competency statements should take into account the contributions already made in this effort. However, blind adoption of any set of middle school science teacher competencies could have disastrous consequences on the science curriculum and on science teacher morale. Local efforts would be best served if the philosophy of the middle school and the goals and objectives of the science program as perceived by the community are clearly stated and endorsed by the community. Then, and only then, will optimum conditions exist for developing middle school science teacher competencies.

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